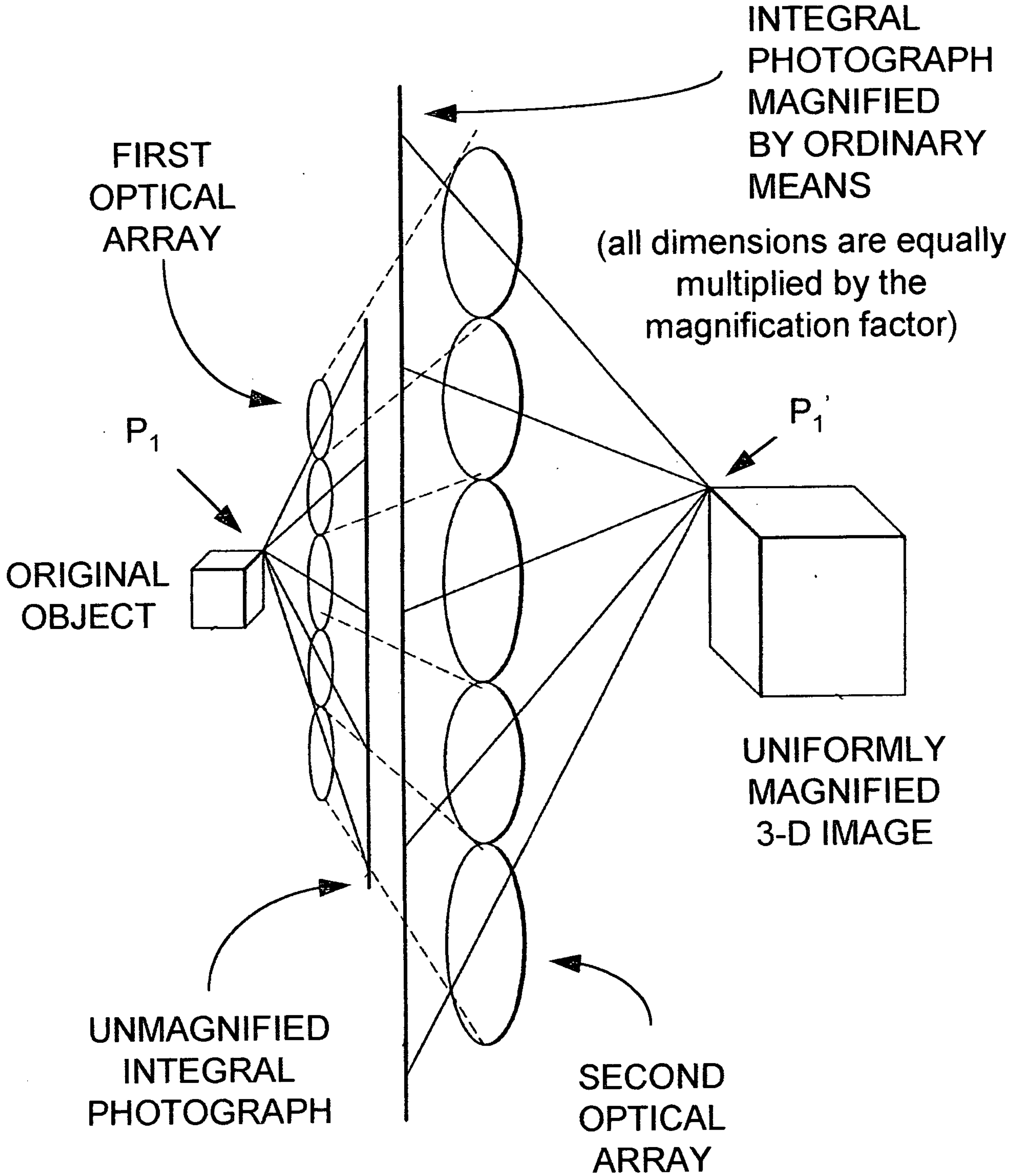
PRIORITY INSTRUMENTS

(Incorporated By Reference)

- Provisional Appl. No. 60/051,972 Filed: Jul. 8, 1997
- Non Prov. Appl. No. 09/111,990 Filed: Jul. 8, 1998
- US Patent 6,229,562 Granted: May 8, 2001 (The '562 Patent)
- Non Prov. Appl. No. 09/749,984 Filed: Dec. 27, 2000 (Continuation)
- US Patent 6,593,958 Granted: Jul. 15, 2003 (The '958 Patent)
- Non Prov. Appl. No. 09/853,790 Filed: May 11, 2001 (Continuation-In-Part)
- US Pre-Grant Pub. No. 2001/0028485 A1 Pub.: Oct. 11, 2001 (The Present Appl.)

THE MAGNIFICATION PRINCIPLE



P_1 is a point on the object. P_1' is the corresponding point on the magnified image. Rays pass through centers of the optical elements. Magnification multiplies the center distances by the magnification factor.

THE MAGNIFICATION PRINCIPLE

The present invention, in all its embodiments, is based upon a method that permits magnification of a three-dimensional image produced from a photograph, hologram or other system or device, regardless of the medium or the method, in such a manner as to preserve the depth to height and width relationship of the image as it existed prior to magnification. This method requires the three-dimensional image prior to magnification to be rendered as an array of two-dimensional images by some form of matrix lens array, such as a fly's eye lens. Were this array of two-dimensional images to be magnified by some magnification factor, and then viewed or projected through a new matrix lens array that has been scaled up from the lens array that produced the original array of two dimensional images, such that the scaling factor is equal to the magnification (i.e., the focal length and diameter of each lenslet must be magnified by the same magnification factor), a new three-dimensional image would be produced that would be magnified by the same magnification factor, and all image dimensions would be magnified by the same factor such that all dimensions of the final three-dimensional image would be proportional to the dimensions of the original image. (7:66-8:19)

The magnification principle is illustrated in FIG. 1. Object 1 is photographed by matrix lens array 2, thereby producing integral photograph 3. Integral photograph 3 is then magnified to give integral photograph 4 which is then placed behind matrix lens array 5. This combination yields magnified image 6. It must be noted here, that during scaling-up, the (F/#) of the lenslets remains constant. (8:26-32)

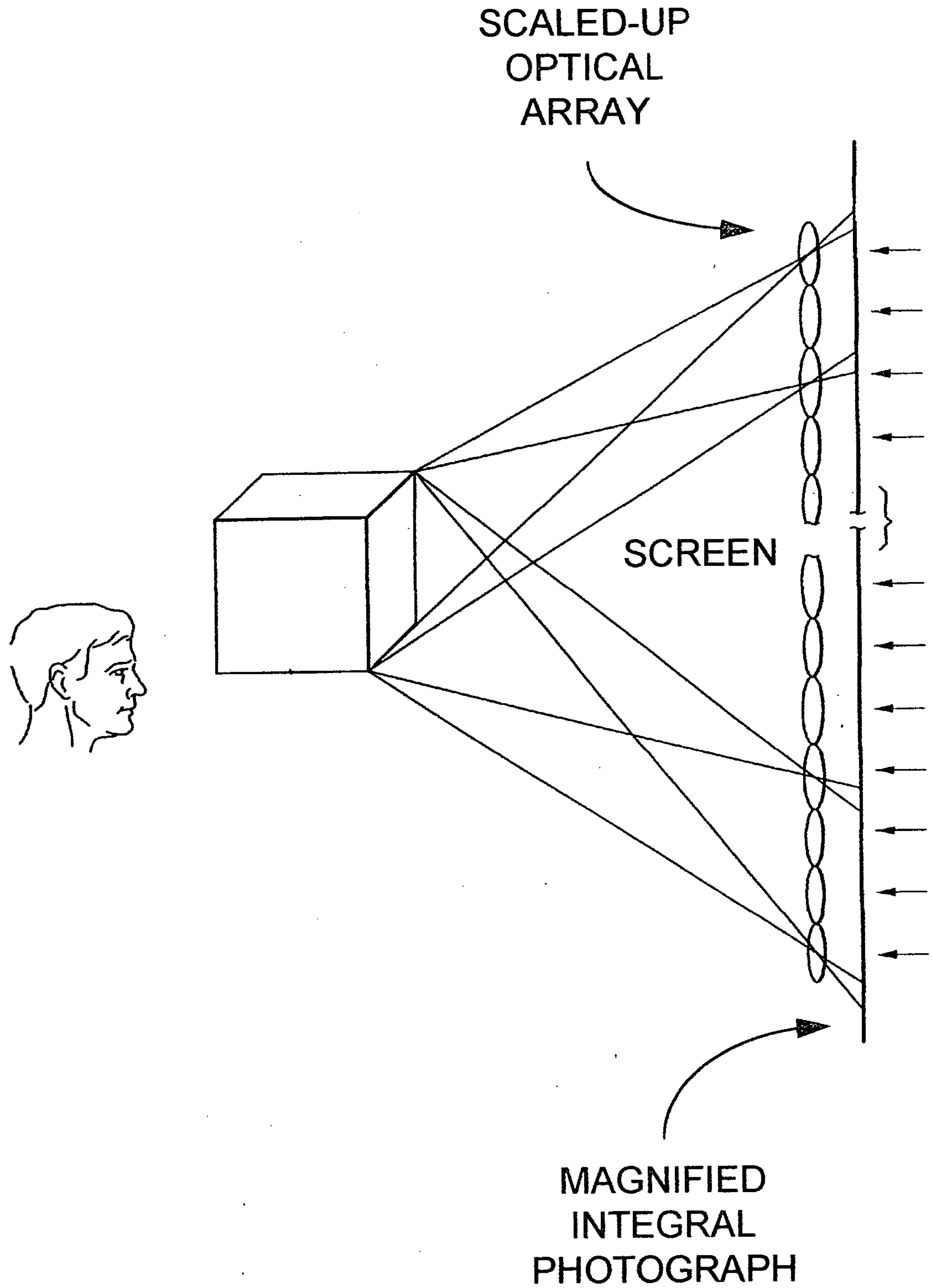
What is claimed is:

1. A system for the production of a second three-dimensional image magnified from a first three-dimensional image in substantially the same proportions, said system comprising:

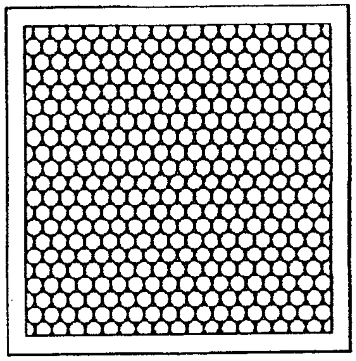
   a first active optical system for creating from the first three-dimensional image, a first two-dimensional array comprised of a plurality of two-dimensional elemental images, said first active optical system having a first F-number and comprised of a plurality of focusing means wherein the number of focusing means is equal to the number of elemental images and wherein the configuration of the focusing means substantially corresponds to the configuration of the elemental images in the array;

   means for magnifying the first array equally in all dimensions to create a second two-dimensional array comprised of a plurality of two-dimensional elemental images; and,

   a second active optical system for reconstructing a second three-dimensional image that is a magnification of the first three-dimensional image that is a magnification of the first three-dimensional image, said active optical system having a second F-number equal to the first F-number and comprised of a plurality of focusing means wherein the number of focusing means substantially corresponds to the configuration of elemental images in the array and wherein all of the component parts of an equation for determining the second F-number are substantially the same multiples of all the component parts for determining the first F-number, respectively, said multiple being equal to the selected magnification factor.

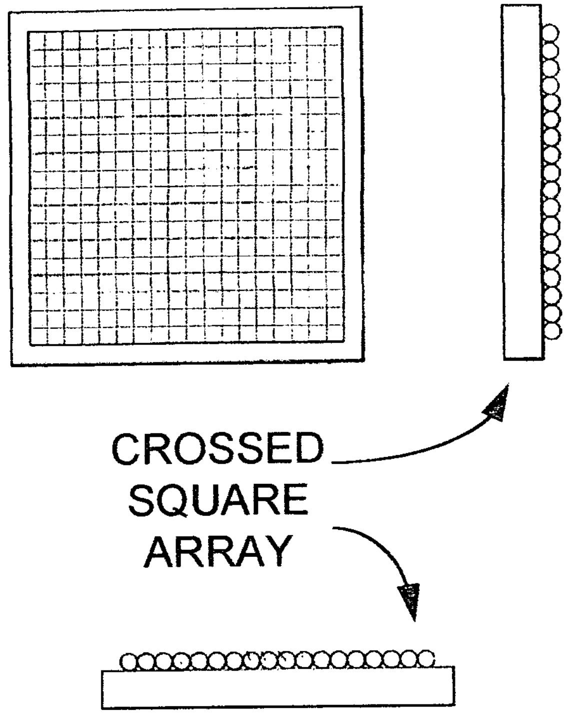

SCALED-UP
OPTICAL
ARRAY
SCREEN
MAGNIFIED
INTEGRAL
PHOTOGRAPH

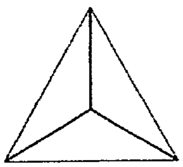
SPHERICAL LENSLETS



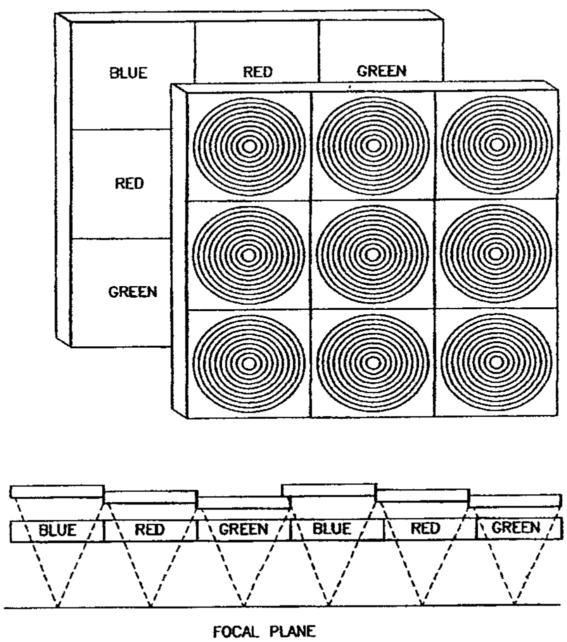
HEXAGONALLY CLOSE PACKED

CYLINDRICAL LENSLETS

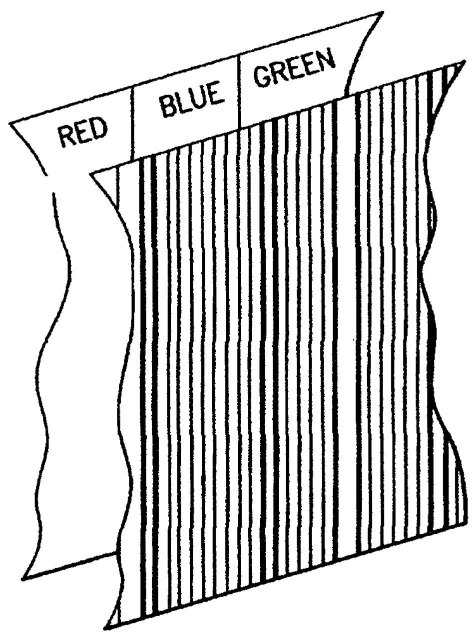




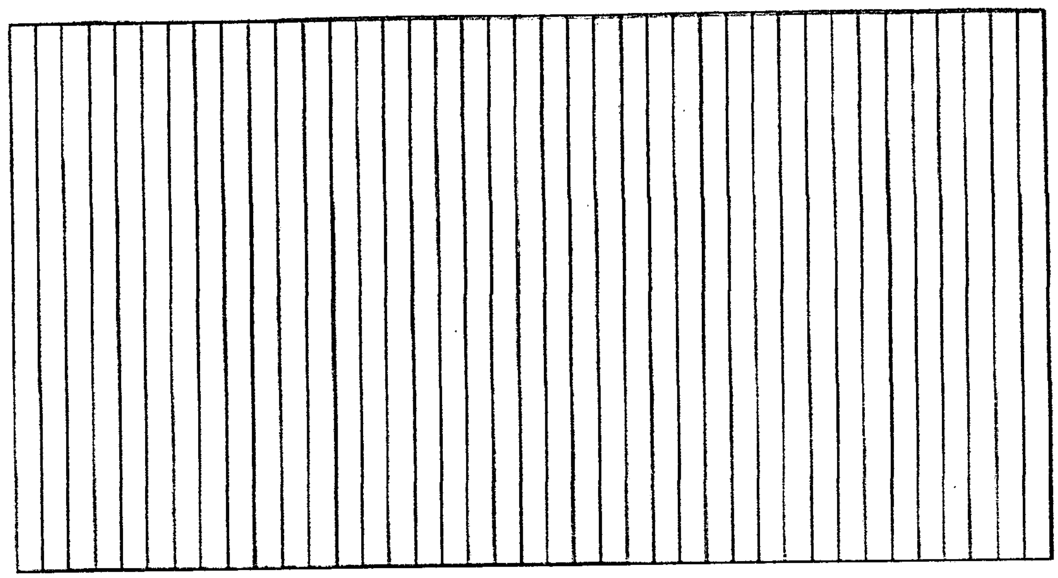
CORNER CUBE SCREEN



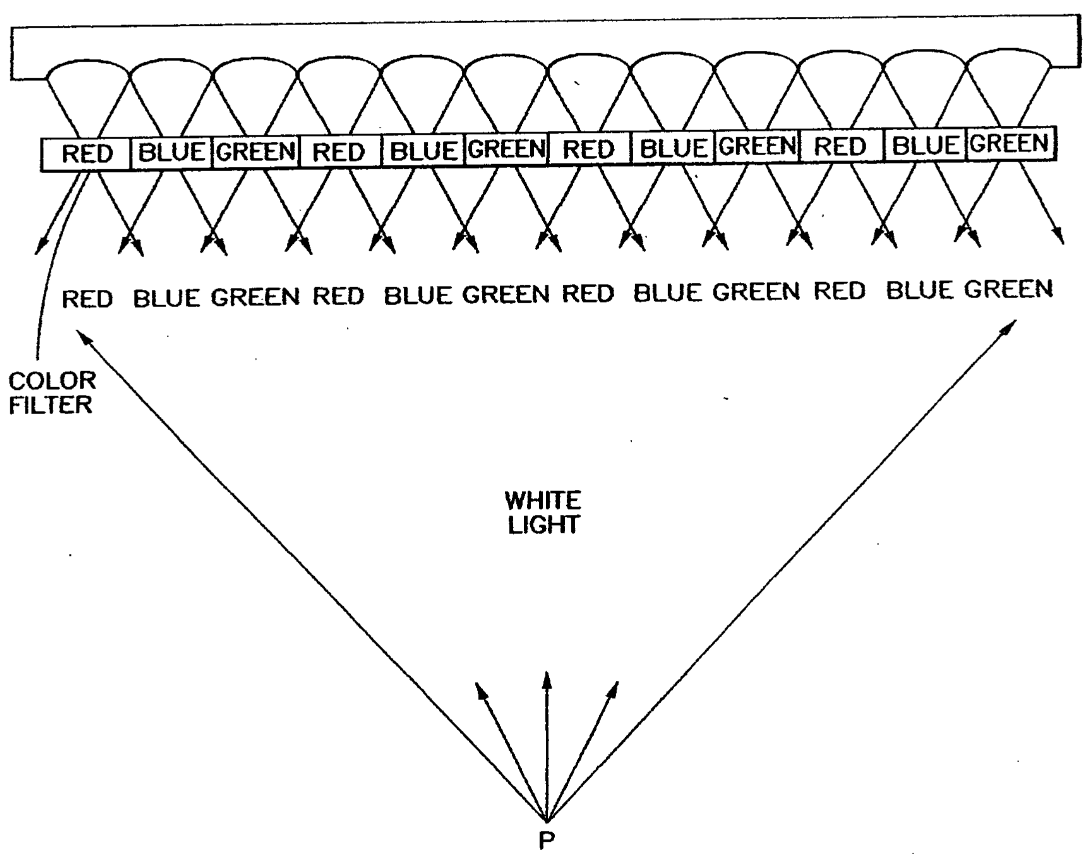
SQUARE ARRAY CIRCULAR FRESNEL ZONE PLATES



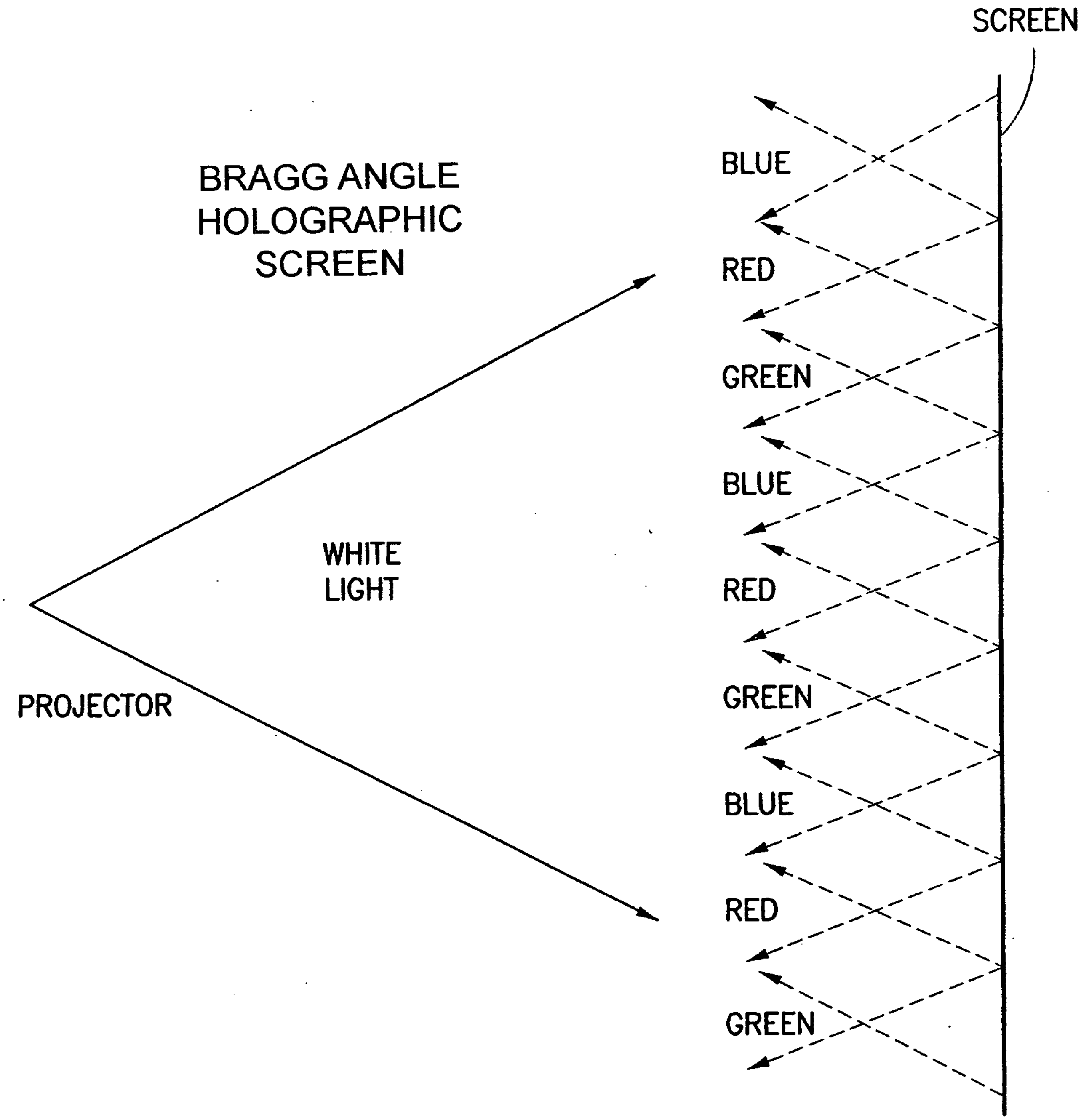
LINEAR ARRAY UNI-DIRECTIONAL ZONE PLATES



CYLINDRICAL LENTICULAR OR BONNET SCREEN



CONCAVE SPHERICAL MIRRORS WITH COLOR PLATE

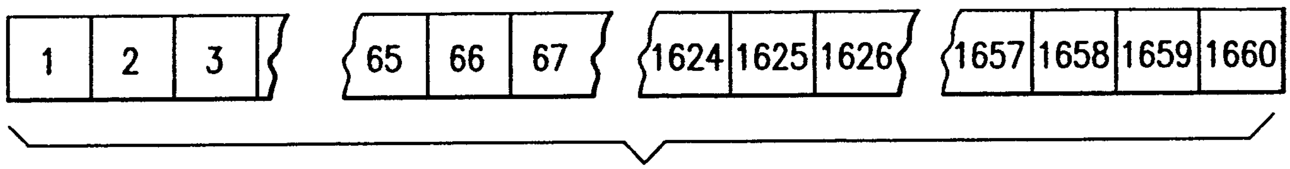


BRAGG ANGLE
HOLOGRAPHIC
SCREEN
SCREEN
BLUE
RED
GREEN
BLUE
RED
GREEN
BLUE
RED
GREEN
WHITE
LIGHT
PROJECTOR

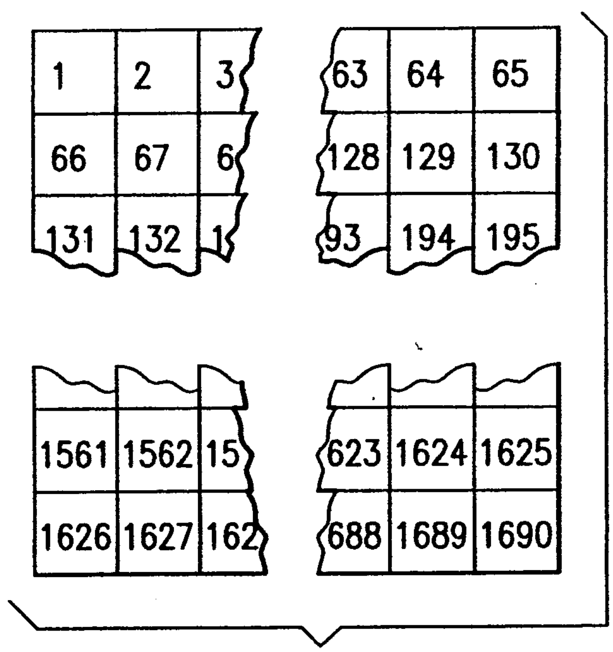
SOLVING THE RESOLUTION PROBLEM

- Make the recording medium frame larger
- Record in Black-and-White and reconstruct in color
- Eliminate vertical parallax
- MULTIPLEX the recorded image and UNMULTIPLEX prior to viewing the reconstructed image. This requires several stages.

MULTIPLEXING

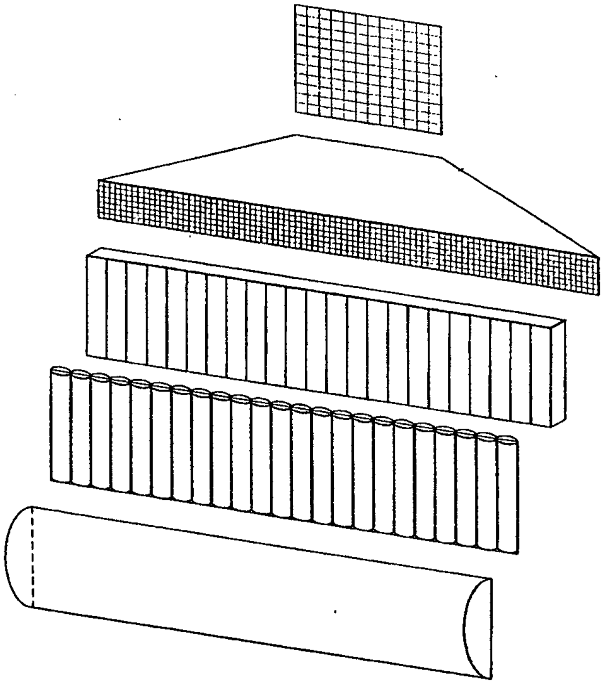


STEP 1: Compress Entire Linear Integral Image
in the Vertical Direction

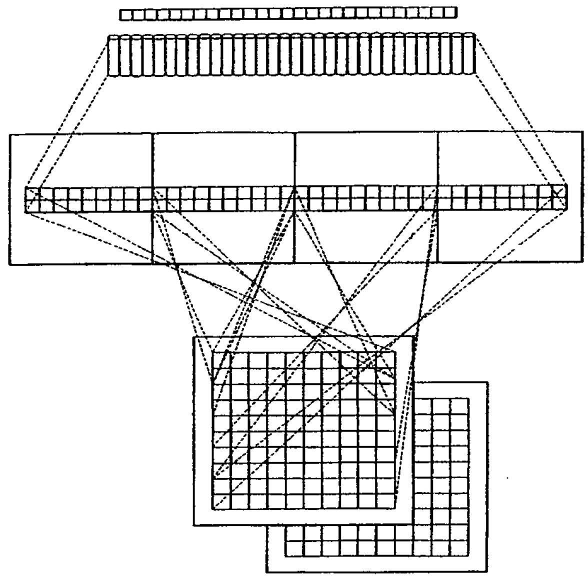


STEP 2: Rearrange Compressed
Elemental Images

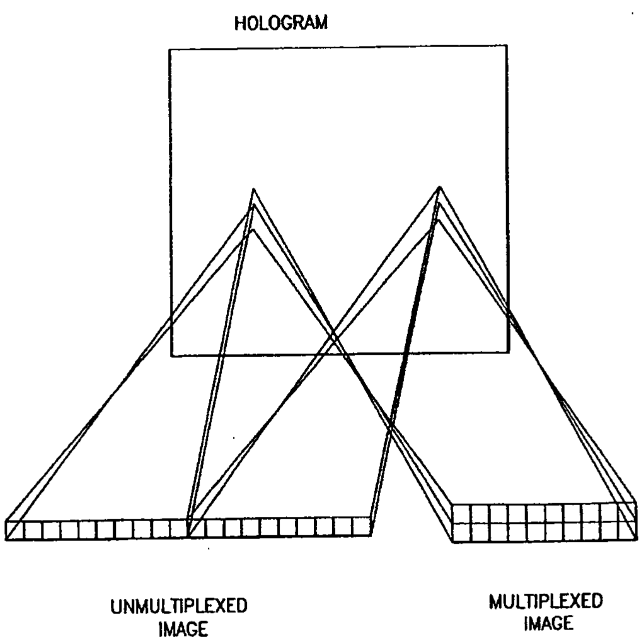
MULTIPLEXING/UNMULTIPLEXING



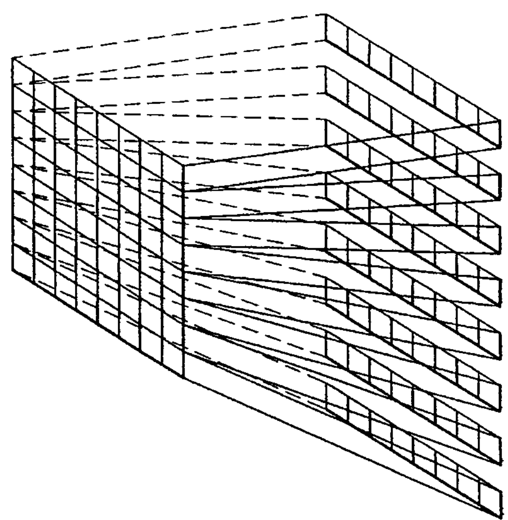
FIBER OPTICS MULTIPLEXING



HOLOGRAPHIC MULTIPLEXING

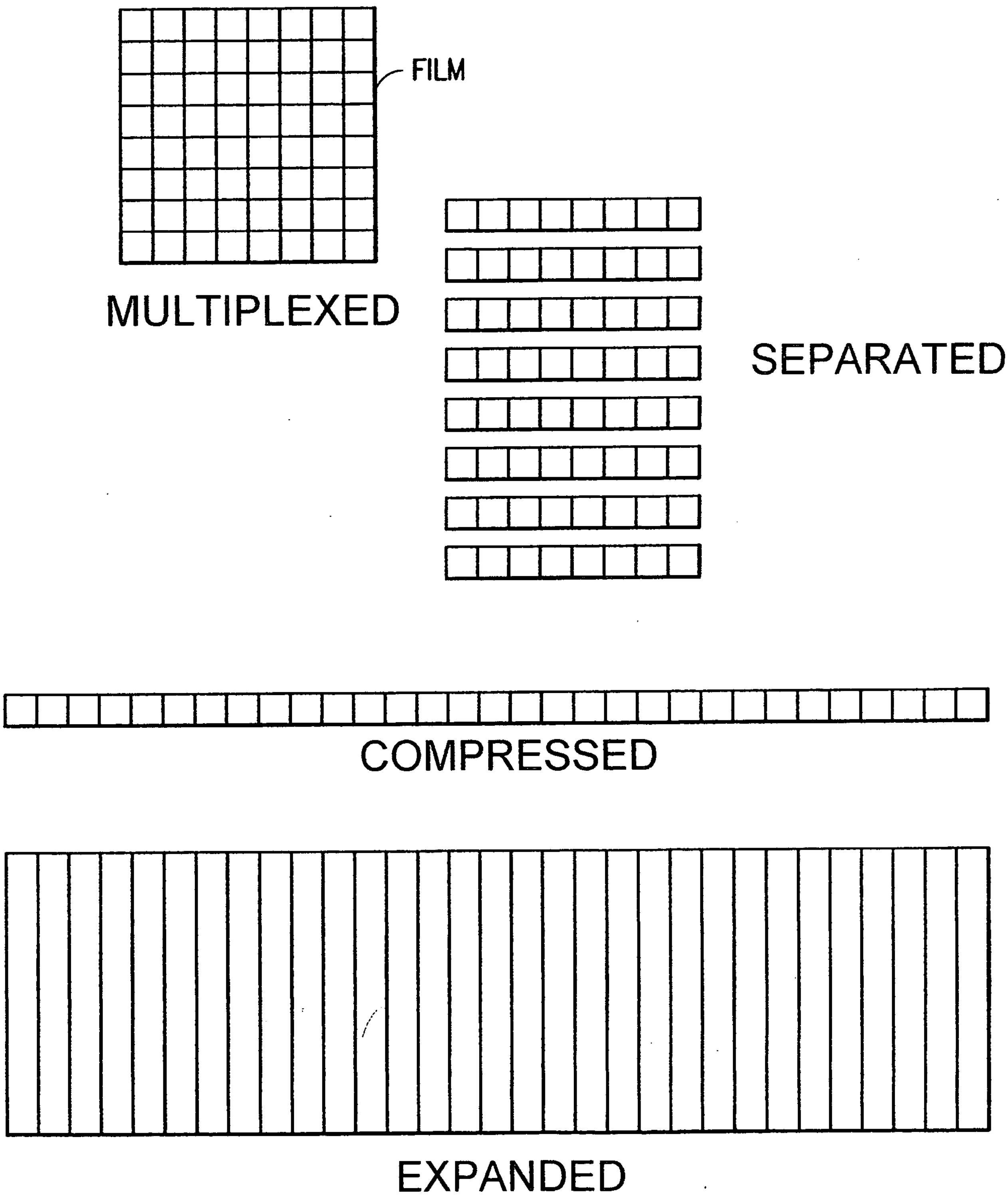


HOLOGRAPHIC MULTIPLEXING/UNMULTIPLEXING



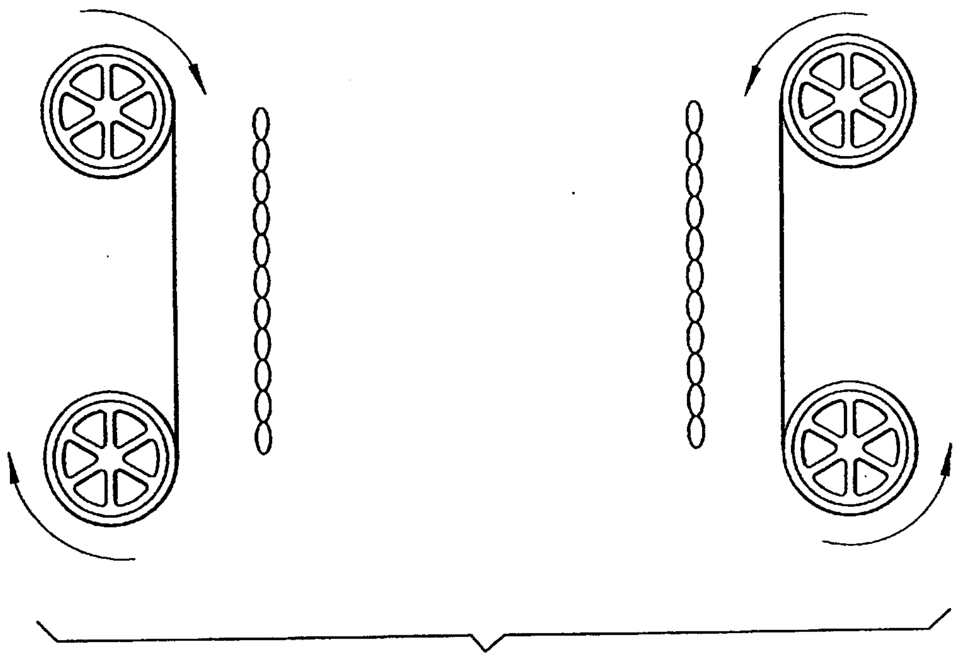
UNMULTIPLEXING

APPLICATION OF MULTIPLEXING

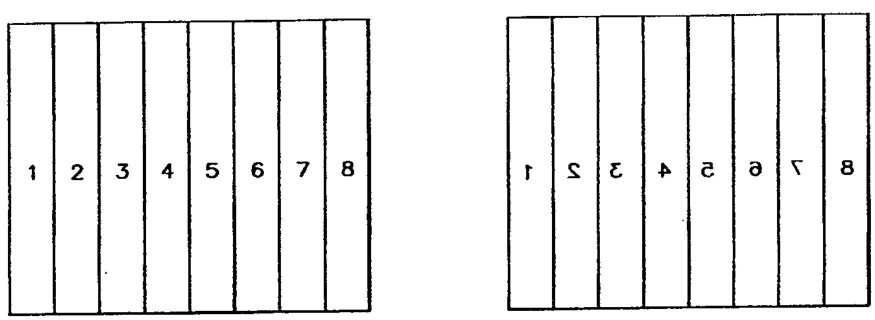


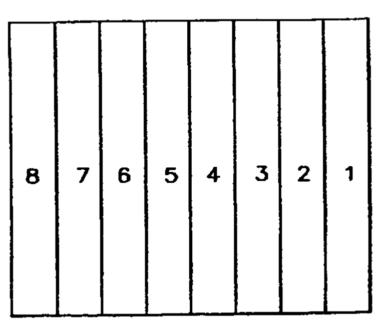
EVERSION

PSEUDOSCOPY TO ORTHOSCOPY



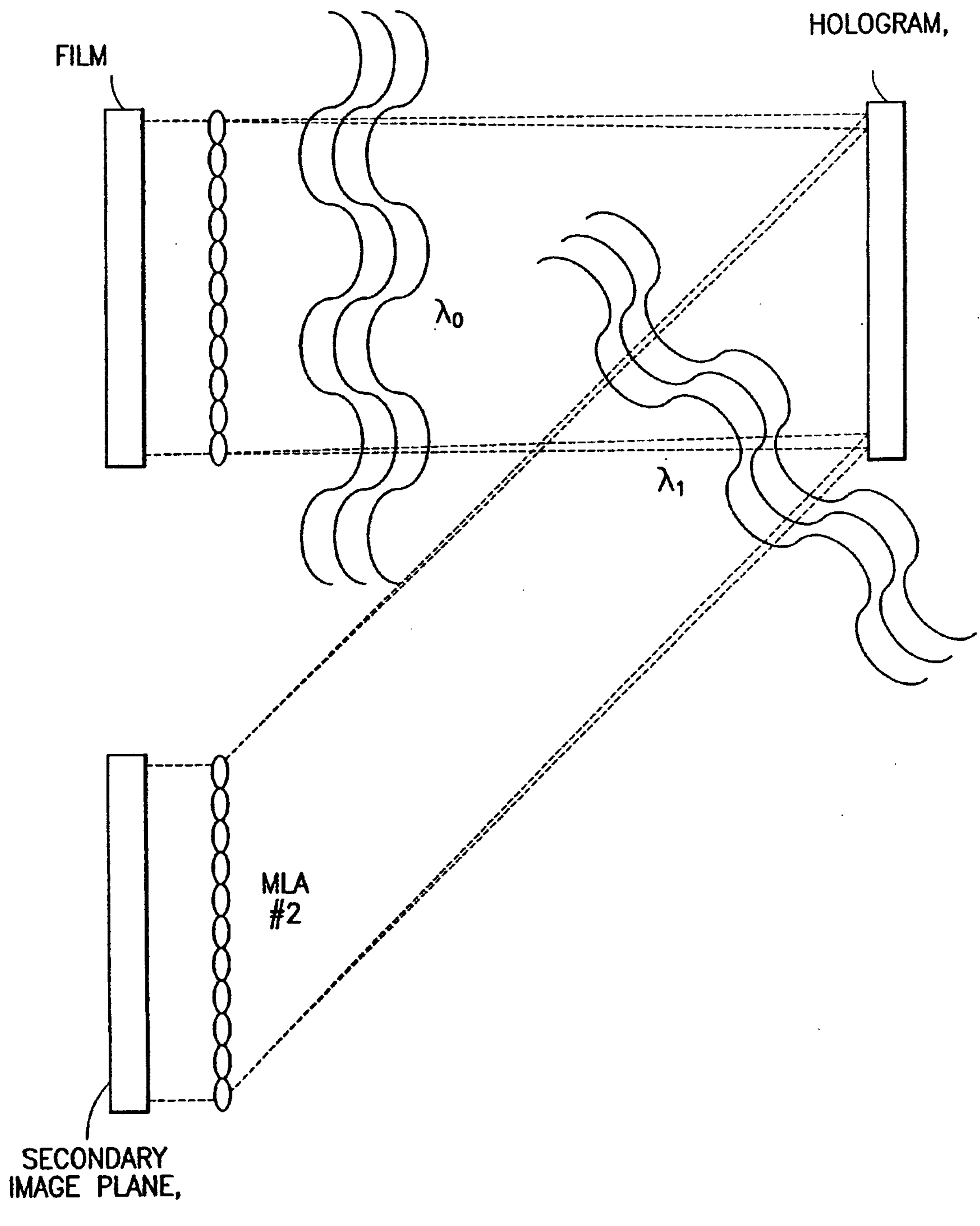
METHOD #1 - DIRECT EVERSION



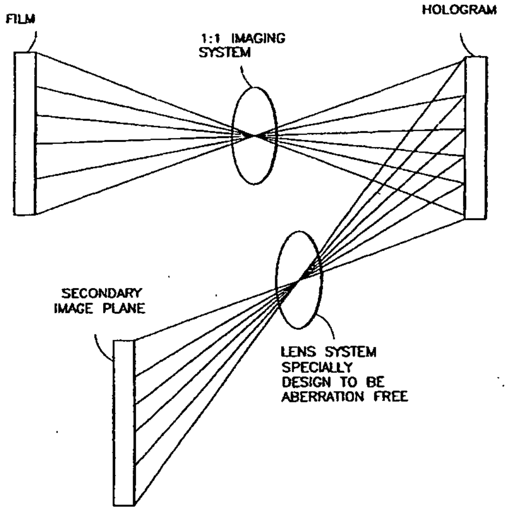


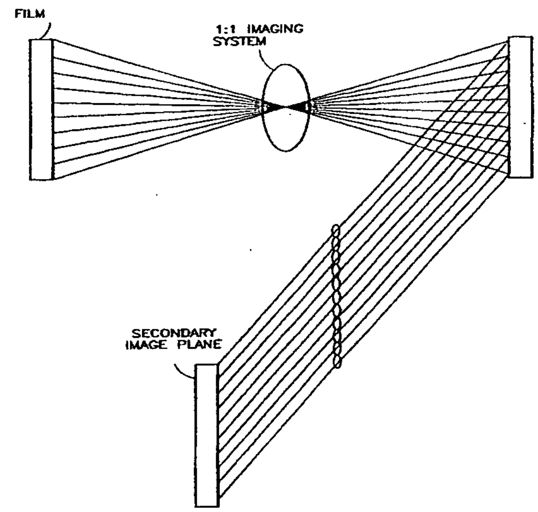
METHOD #2 - ELEMENTAL REVERSAL

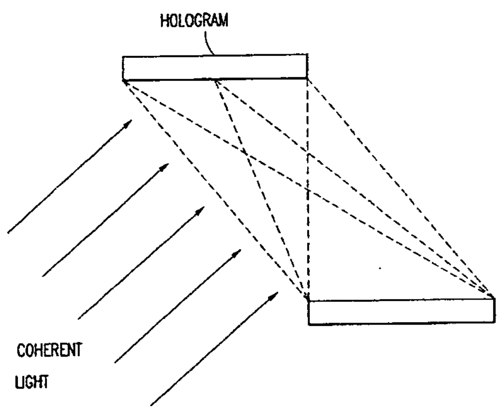
DIRECT FABRICATION OF HOLOGRAPHIC OPTICS

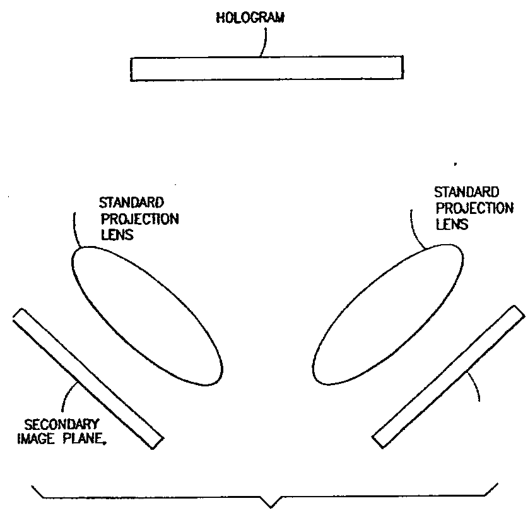


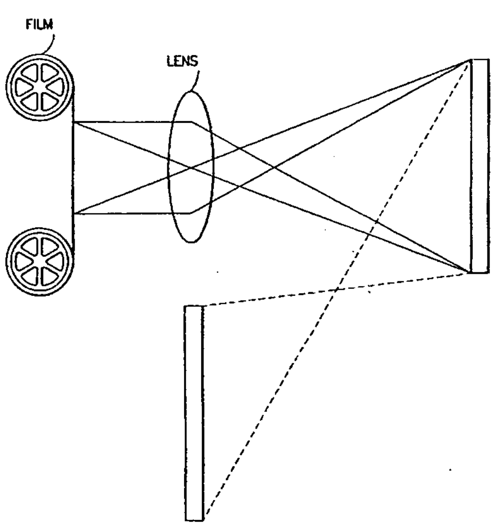
HOLOGRAPHIC OPTICAL ELEMENTS

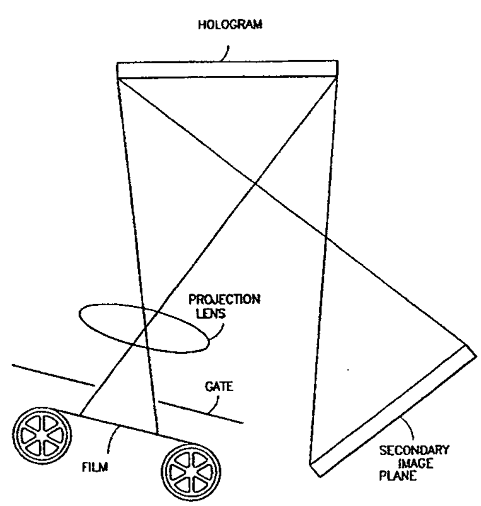




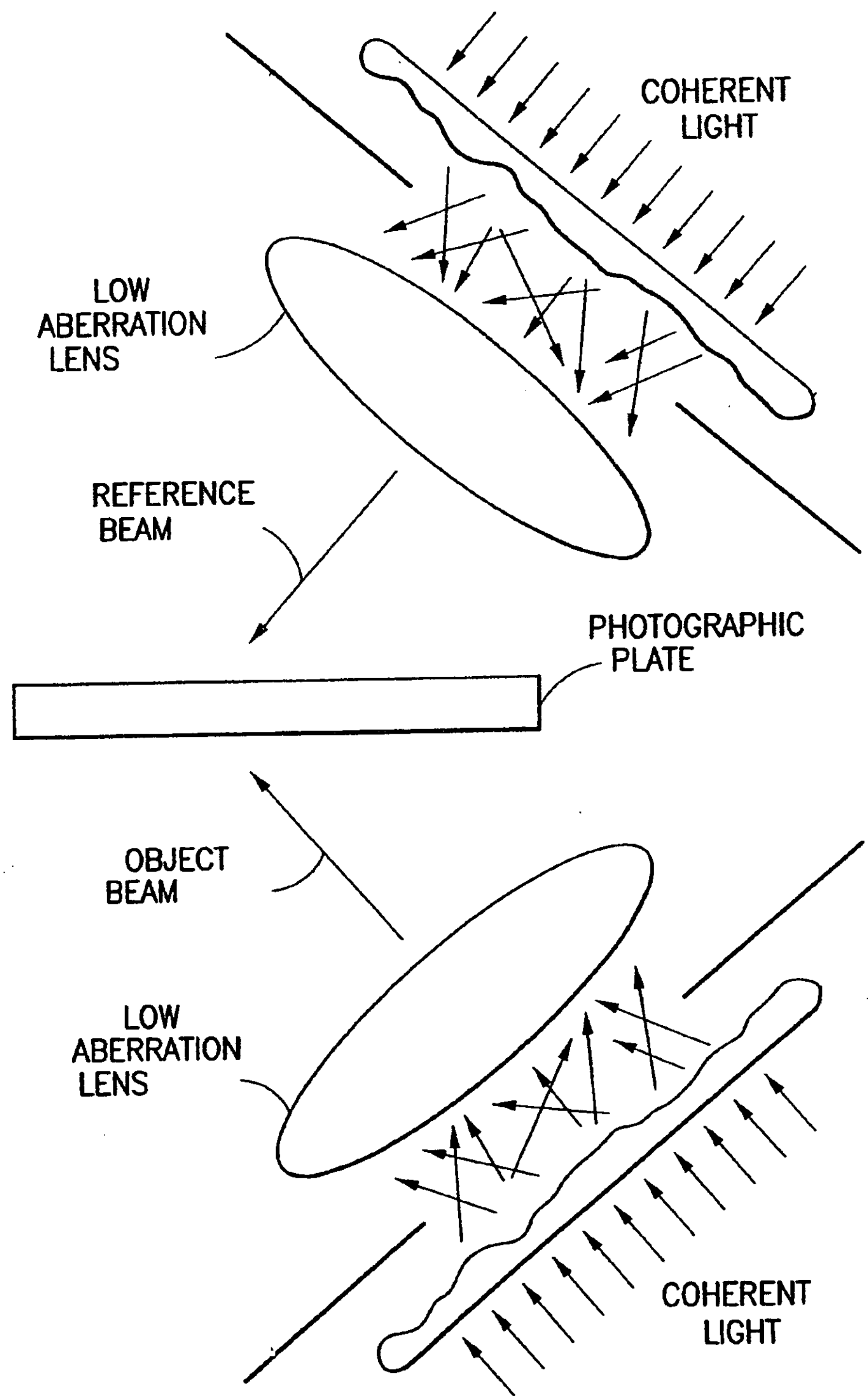




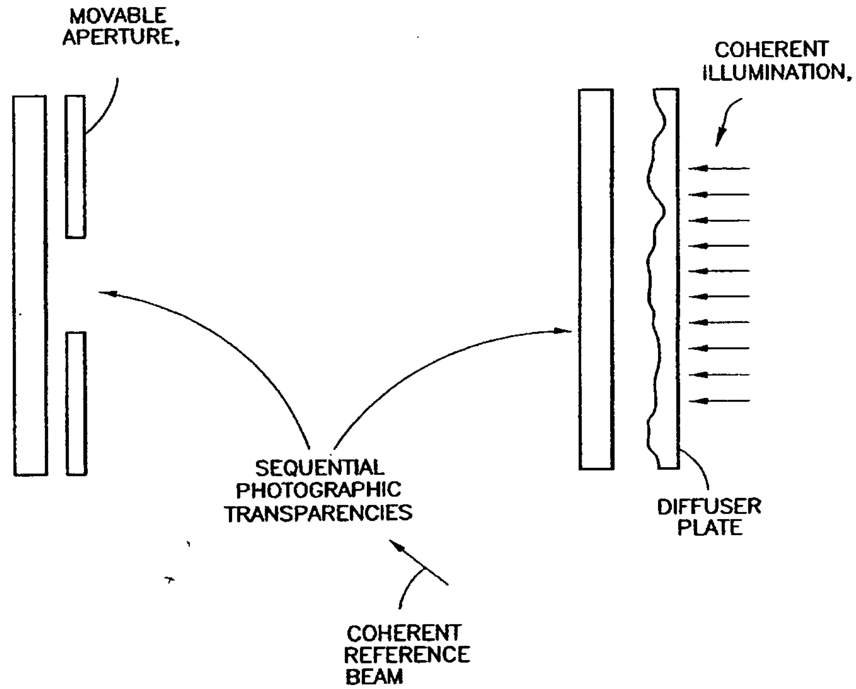


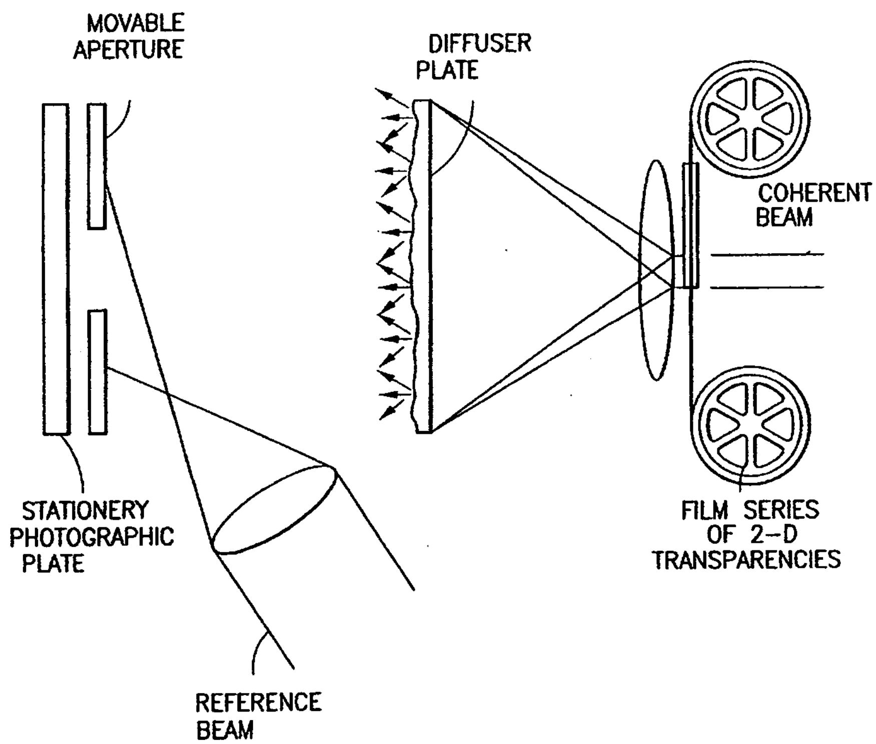


FABRICATION OF HOLOGRAPHIC OPTICAL ELEMENTS USING APERTURES



MAKING HOLOGRAMS FROM INTEGRAL PHOTOGRAPHS





HOLOGRAPHIC FILM STRIP WITH HORIZONTAL APERTURE